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Marketplace or Reseller?

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Intermediaries can choose between functioning as a marketplace (in which suppliers sell their products directly to buyers) or as a reseller (by purchasing products from suppliers and selling them to buyers). We model this as a decision between whether control rights over a noncontractible decision variable (the choice of some marketing activity) are better held by suppliers (the marketplace mode) or by the intermediary (the reseller mode). Whether the marketplace or the reseller mode is preferred depends on whether independent suppliers or the intermediary have more important information relevant to the optimal tailoring of marketing activities for each specific product. We show that this trade-off is shifted toward the reseller mode when marketing activities create spillovers across products and when network effects lead to unfavorable expectations about supplier participation. If the reseller has a variable cost advantage (respectively, disadvantage) relative to the marketplace, then the trade-off is shifted toward the marketplace for long-tail (respectively, short-tail) products. We thus provide a theory of which products an intermediary should offer in each mode. We also provide some empirical evidence that supports our main results.

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1. Introduction

Retailers such as 7-Eleven, Eastbay, Lowe's, and Zappos act as intermediaries by reselling the products they purchase from suppliers to buyers. Other intermediaries, such as the Alibaba Group, eBay, and the Premium Outlets and Simon Malls of the Simon Property Group, act as marketplaces, in which suppliers sell directly to buyers via a platform. In the existing literature, the intermediation model—reseller or marketplace—is taken as given. It is important to recognize, however, that intermediaries can often choose under which mode to operate.

For example, most electronics retailers function as resellers. They take ownership and control over products from branded suppliers and choose how to sell them in their stores (layout, pricing, promotions, emphasis, etc.). Recently, however, the largest such retailer in the United States, Best Buy, has taken a step toward the marketplace mode by allowing Apple, Samsung, and Microsoft to launch their own ministores within Best Buy stores (Apple in 2011 and Microsoft and Samsung in 2013). These brands control the product layout in these ministores and staff them with their own product specialists; Samsung even offers its own checkout service (see Ovide and Zimmerman 2013, Zimmerman 2013). Similarly, Buy.com was founded in 1997 as a pure online reseller, but starting in 2006, it aggressively expanded its marketplace offering. By 2010, when it was acquired by Rakuten, Japan's largest online shopping mall, Buy.com was a hybrid, with sales roughly evenly distributed between the reseller and the marketplace modes (see Fowler and Wakabayashi 2010). In 2013, it was rebranded Rakuten.com Shopping and was reportedly moving toward a 100% marketplace mode (see Heller 2013). An example of a transition in the opposite direction is provided by Zappos, the leading online shoe retailer in the United States, which started off in 1999 as a marketplace but turned itself into a pure reseller by the mid-2000s, before its 2009 acquisition by Amazon. Other examples where intermediaries make such choices include department stores (resellers for some product categories and marketplaces for others, most notably cosmetics, where branded suppliers control independent counters), Amazon (a pure reseller at its start but now operating as a marketplace as well), and digital content intermediaries (e.g., Comcast, DirecTV, Apple's iTunes, and Netflix operate as resellers, whereas Apple's iPhone App Store and Google Play operate mostly as marketplaces).

This paper analyzes the choice facing an intermediary of operating as a marketplace, as a reseller, or as a hybrid, having some products offered under each of the two different modes. What are the trade-offs that drive an intermediary to adopt one mode over the other, or both? We present a formal model to analyze some of the fundamental trade-offs that arise in comparing resellers with marketplaces and determining which products to offer under each mode.

We take the view that a fundamental distinction between marketplaces and resellers is the allocation of control rights between independent suppliers and the intermediary over noncontractible decisions (prices, advertising, customer service, responsibility for order fulfillment, etc.) pertaining to the products being sold. In the case of a pure marketplace, all of these residual control rights rest with independent suppliers. In the case of a pure reseller, all residual control rights rest with the intermediary (i.e., the reseller).

In our model, we focus on a single, noncontractible decision variable that can be interpreted as the choice of some marketing activity that occurs through this particular intermediary and that is undertaken by the party holding residual control rights (i.e., the reseller, or each independent supplier in the case of a marketplace). Examples of such an activity include the way in which a product is displayed, or the extent to which its brand is promoted relative to its features (e.g., through in-store signage or sales staff). The intermediary and the suppliers each have private information about the ideal choice of the marketing activity. Drivers of the optimal intermediation mode that we analyze include the relative importance of the suppliers' versus the intermediary's private information, the presence of spillovers across products generated by marketing activities, whether products are long tail or short tail, and a possible chicken-and-egg problem faced by the marketplace when suppliers hold unfavorable expectations about other suppliers' participation on the marketplace. We also establish conditions under which a hybrid mode is optimal and characterize its optimal design in such cases. This paper thus offers a guide to how intermediaries should optimally position themselves between the two different modes. Finally, we offer some empirical evidence that corroborates our model's predictions.

1.1. Literature Review

The marketplaces we study are a type of multisided platform (or two-sided market). Multisided platforms are organizations that get two or more sides on board and enable direct interactions between them. In the case of marketplaces, the two sides are buyers and sellers, and the interaction is the commercial trade between them. Thus, our framework does not fit all types of multisided platforms. For instance, when the two sides are not trading a "product" that can be purchased and resold, the choice to become a reseller does not arise (e.g., a nightclub). Nevertheless, marketplaces are an important subclass of multisided platforms.

Our contribution to the literature on multisided platforms departs from the seminal models in the two-sided market literature (e.g., Armstrong 2006, Caillaud and Jullien 2003, Parker and Van Alstyne 2005, Rochet and Tirole 2003) by focusing on the role of noncontractible decisions and whether the intermediary or the third-party suppliers have control rights over these decisions—a novelty in this literature. An important corollary of our modeling is that the specification of residual control rights helps to distinguish multisided platforms from resellers. Specifically, residual control rights remain with sellers in the case of multisided platforms. The existing literature on two-sided markets has struggled with this issue. According to some existing definitions, grocery stores are examples of multisided platforms, although many economists think they are not (e.g., Rochet and Tirole 2006, Rysman 2009). At the same time, we extend the existing literature by considering multisidedness as a choice rather than as a given characteristic of industries or firms.

The importance of the strategic choice between marketplaces and resellers, and some of the trade-offs that can arise, is discussed in Hagiu (2007) and Hagiu and Wright (2011, 2013). This paper formalizes a framework in which the allocation of residual control rights creates meaningful distinctions between the two modes and emphasizes fundamental trade-offs that were not raised in these earlier works. Note that our focus is on control rights and not on the specific mechanisms through which a marketplace or a reseller reduces buyer and seller search and transaction costs (such as in Bakos 1997). The distinction between the marketplace and reseller modes of intermediation is also present in Hagiu and Lee (2011). Their setup features two downstream intermediaries who first compete for the affiliation of one upstream supplier and then compete for customers (buyers). However, in their analysis the mode of intermediation (marketplace or reseller) for the two downstream firms is exogenously given. The focus of their analysis is the effect of the intermediation model on the likelihood that the upstream supplier deals exclusively with one intermediary as opposed to both.

By equating the difference between marketplaces and resellers to the allocation of residual control rights between independent suppliers and the intermediary, our work is loosely related to the voluminous literature on vertical integration and the theory of the firm (e.g., see Grossman and Hart 1986, Hart and Moore 1990, Williamson 1975). However, rather than studying "make-or-buy" decisions, we study "enable-or-resell" decisions, which involve quite a different economic analysis. The key difference is the following. In the make-or-buy (vertical integration) decision, regardless of the choice, the focal firm contracts with and controls the sale to buyers. By contrast, in the "enable-or-resell" decision, the marketplace mode involves contractual relationships between buyers and suppliers, to which the focal firm (intermediary) is not a party—it is merely an enabler of those contractual relationships. Consequently, the specific trade-offs are different. In particular, consider contractual incompleteness. When complete contracts are infeasible, vertical integration (equivalent to the allocation of residual control rights) is driven by the need to minimize holdup risk by (or of) some suppliers, because holdup risk tends to lead to suboptimal relationship-specific investments (Grossman and Hart 1986). This issue is not very relevant for the marketplace-or-reseller decision since the holdup by (or of) a supplier remains a risk whether the intermediary is a marketplace or a reseller. Conversely, the contractual incompleteness in our model relates to noncontractible actions that must be made contingent on information that is revealed after the intermediary contracts with suppliers and before the products are sold to buyers. This issue has little, if any, relevance to make-or-buy decisions.

More closely related to our paper is a literature on organizational design that explores whether centralized or decentralized decision making is better. At a high level, we share with this literature the focus on noncontractible decisions (ex ante and ex post) and on the trade-offs that arise from allocating the relevant decision rights to different parties. Loosely speaking, centralization corresponds to our reseller mode and decentralization corresponds to our marketplace mode. See, for example, Alonso et al. (2008, 2014), although their focus on strategic communication (in their 2008 paper) and the trade-off between information breadth and depth (in their 2014 paper) is very different from ours.

Finally, our work relates to the recent work by Gans (2012), Foros et al. (2013), and Johnson (2013, 2014) that analyzes the agency model (i.e., suppliers set prices and share revenues with downstream retailers) and contrasts it with the traditional wholesale model (i.e., suppliers set wholesale prices and retailers set retail prices). These articles explore the implications of specific contract forms that have recently emerged in the selling of digital content (e.g., application stores and e-books). Our paper complements this emerging literature given that contract forms are largely neutral in our analysis—we instead focus on the role of private information and noncontractible decisions.

2. Model Setup

There are $N > 1$ independent suppliers. Each supplier $i = 1, \ldots, N$ has a unique product. The marginal cost of supplying each product (i.e., the opportunity cost to suppliers of providing the product for sale) is normalized to zero without loss of generality. To sell the products to buyers, suppliers must go through a monopoly intermediary.

Initially, in our model all products (and all suppliers) are treated symmetrically. This allows us to show the trade-offs we are interested in most clearly when focusing on the choice between a pure reseller (R) and a pure marketplace (M). The role of asymmetries across products is discussed in §4, where such asymmetries provide a natural explanation of why intermediaries may prefer a hybrid mode.

2.1. Demand Structure

There is a continuum of many identical buyers. Each buyer is willing to pay v for each product she is interested in, where v is commonly known. To access the products, buyers must affiliate with (i.e., join) the intermediary, which we assume is costless.

We assume that the number of buyers for product i is

$$m - (a_i - a_i^*)^2,$$

where a_i is the choice of marketing activities made by the owner of product i (supplier i or the reseller) and where

$$a_i^* = \theta + \gamma_i + \delta_i$$

is the ideal choice of marketing activity for product i. We have in mind activities that take place at or over the intermediary and that help to attract (and convert) buyers.

We assume that θ is commonly known. The term γ_i is an independent and identically distributed (i.i.d.) random variable whose realization is private information known to the intermediary at the time it chooses its marketing activities. Similarly, the term δ_i is an i.i.d. random variable whose realization is private information known to supplier i at the time that the supplier chooses its marketing activities. The random variables γ_i and δ_i are drawn independently for all i, and they have expected values equal to zero and variances denoted as V_γ and V_δ, respectively.

The key assumption is that marketing activities a_i are noncontractible: this may be because they encompass unobservable actions or are too costly to fully specify in a contract. Still, an intermediary or supplier that was fully informed of γ_i and δ_i would be able to choose the ideal marketing activity for product i and thereby achieve the highest level of demand possible (i.e., m). We therefore also assume that the private information contained in γ_i and δ_i is prohibitively hard to communicate to the other party in a cost-effective manner. Absent full information, neither suppliers nor the intermediary can expect to make the ideal choice of marketing activities. The extent to which the owner of product i (supplier i or the reseller) is expected to be *less* effective depends on the variance of the component of a_i^* that it does not observe. Thus, the relative importance of the intermediary's versus the suppliers' local information is captured by the comparison between V_γ and V_δ.

Our formulation of marketing activities above is best interpreted as representing a "horizontal choice." A given product can be marketed in multiple ways, all at the same cost, which we normalize to zero. For example, suppose there is a fixed amount of promotion that can be done for each TV product at Best Buy: the amount may be restricted by the available signage space or by the limited amount of time that sales staff have to discuss products with potential buyers. That fixed promotional capacity can be allocated between two activities: emphasizing the specific brand of the TV set versus emphasizing specific product features (e.g., high-definition or smart TV functionality). One can then interpret a_i as the relative amounts of promotional capacity allocated to brand emphasis and promotional capacity allocated to emphasis of product features. If a_i is below the ideal level a_i^*, then further emphasizing the brand at the expense of product features will attract more buyers to product i, and conversely if a_i is above the ideal level a_i^*.[1]

More generally, one can think of a_i as encompassing dimensions of how shelf space or stores (physical or virtual) are laid out. Suppliers and the reseller may have different information about the best way to make such layout decisions. Different layout arrangements have similar costs, so these can be considered horizontal decisions. For instance, one dimension along which suppliers and the reseller might have different information is the extent to which demand is maximized by putting the same brand's products close together versus putting complementary products (of different brands) close together.

Needless to say, there are other ways to formulate how marketing activities affect demand. For our purposes, there are two critical modeling ingredients: (i) the marketing choice is influenced by the private information embodied in a_i^*, and (ii) the optimal choice a_i^* is well defined as a result of diminishing returns to marketing. In §5.1 we provide an alternative modeling formulation in which a_i can be interpreted as the level of investment in marketing, so a higher a_i always increases demand, with the marginal effectiveness proportional to a_i^*. By assuming quadratic marketing costs, we show that the baseline trade-offs in §3 remain the same.

[1] We are grateful to an anonymous referee for pointing out this interpretation of our model.

2.2. Cost Structure

If the intermediary is a marketplace, each individual supplier incurs a fixed cost, denoted by $F_M > 0$, which is the cost of setting up the capability of selling in the marketplace. Each supplier also incurs a constant transaction cost of selling each unit of its product, equal to f_M. If the intermediary is a reseller, it incurs a fixed cost $F_R > 0$ for each product it offers (e.g., the costs of quality control, inventory capacity, contractual arrangements). The transaction cost of R selling each unit of a product is equal to f_R. We add the natural assumption that $v > f_k$ for $k \in \{M, R\}$. We also assume that the profit from each product is positive regardless of whether it is offered under the R mode or the M mode. Equations (4) and (8) in §3 show that a sufficient condition to ensure this property is

$$(v - f_k)[m - \max(V_\delta, V_\gamma)] > F_k \tag{1}$$

for $k \in \{M, R\}$.

Initially, we assume that $f \equiv f_M = f_R$ and $F \equiv F_M = F_R$, so that the cost structure of supplying n products is the same under the two different modes of intermediation. This assumption will be relaxed in §3.2, where we focus on cost differences that can affect the choice between the two modes. We normalize the fixed costs of setting up an intermediary (i.e., before it sells any products) to zero, regardless of its mode.

2.3. Pricing Instruments and Control Rights

If the intermediary chooses the R mode, it makes a take-it-or-leave-it contract offer to $n \le N$ suppliers. The offer consists of the price R will pay for each unit it buys, in exchange for which R obtains the control rights over marketing and pricing to buyers. The reseller then chooses marketing activities and prices offered to buyers for all products whose suppliers have accepted the contract offer. As will be noted below, the pricing choice is trivial in our model, so only control over marketing choices matters. Whenever it makes a sale to buyers, R pays the contract price to the corresponding supplier.

If the intermediary chooses the M mode, its take-it-or-leave-it contract offer to $n \le N$ suppliers consists simply of a fixed participation fee P that each supplier must pay in order to join. In our benchmark setting, restricting M to a participation fee is without loss of generality: it would not do any better if it were able to observe supplier sales and charge variable fees. Where there is a role for variable fees, this will be explicitly noted and analyzed. Participating suppliers maintain control over marketing activities and pricing to buyers, to whom they sell directly. In particular, there is no access fee to buyers. As will become clear below, this assumption is immaterial since in our benchmark model, buyers are left with zero surplus.

Consistent with our distinction between marketplaces and resellers, we assume only one party (R or the corresponding supplier i) has control rights over marketing activities for a given product i that affect consumer demand through this particular intermediary. This does not rule out that suppliers may also choose marketing activities through channels other than the intermediary, but these are assumed to work independently of the activities we are studying, so we abstract from them.

The reason we have chosen marketing activities as the focal decision variable is twofold. First, in many real-world contexts, prices are set by contracts between suppliers and intermediaries (e.g., through resale price-maintenance agreements). In such contexts, pricing decisions do not create any meaningful economic distinctions between marketplaces and resellers. By contrast, marketing activities are much less likely to be contractible. For instance, it would be very hard for Sony to enforce specific ways in which Best Buy salespeople are supposed to talk about Sony products to customers. The only realistic way Sony could do this would be to have its own salespeople in Best Buy stores—a situation that is captured by the marketplace mode in our model. Second, from a modeling perspective, it turns out that working with marketing activities is quite tractable and allows us to explore a broad range of trade-offs. For completeness, in §5.5 we consider a version of our model with prices as the noncontractible decision variables and show that our main findings continue to hold.

2.4. Timing

The timing we assume throughout is as follows.

Stage 0. Intermediary chooses mode (reseller or marketplace)	
Reseller	Marketplace
Stage 1. Reseller makes take-it-or-leave-it offer to suppliers; suppliers decide whether or not to accept.	Stage 1. Marketplace sets the fixed participation fee P to suppliers; suppliers decide whether or not to participate.
Stage 2. Reseller learns γ_i for each product and chooses marketing activities and prices to buyers for all products it has acquired.	Stage 2. Each supplier learns its δ_i and chooses the corresponding marketing activity and price to buyers.
Stage 3. Buyers make purchase decisions.	Stage 3. Buyers make purchase decisions.

These particular timing assumptions are not critical to our analysis. The important assumption is that parties should learn their private information before making their decisions about marketing activities. We denote by $E_R[\cdot]$ the expectation taken by R and by $E_i[\cdot]$ the expectation taken by supplier i *after* they learn their private information. We denote by $E[\cdot]$ the expectations taken by either party *before* learning their private information.

Some straightforward implications follow from our timing assumption. First, in all cases, the owner of each product i (supplier i or R) charges buyers a price equal to v, which extracts the entire buyer surplus. Indeed, an informed buyer who wishes to purchase product i does so whenever her opportunity cost of going to the intermediary (zero, by assumption) plus the price charged for the product is less than or equal to her willingness to pay v. This allows us to focus on the key trade-offs between the two modes without introducing any pricing distortions on the buyer side. Since pricing does not depend on local information in any way, it does not produce any meaningful difference between the two modes of intermediation in our model. Thus, whether prices can be contracted or not is irrelevant in our setting. Instead, all the action is concentrated in the choices of marketing activities. Second, the intermediary has all the bargaining power. It therefore extracts the entire *expected* surplus from all participating suppliers.[2] As a result, in the benchmark model, total intermediary profit and total expected surplus (or welfare) are the same. This changes in §3.3, where M suffers from unfavorable supplier expectations.

3. Key Trade-Offs

This section presents the analysis and results for the benchmark setting outlined in the previous section in the case of an intermediary choosing between the R mode and the M mode. We then introduce the possibility of spillovers, cost differences, and network effects to highlight other important trade-offs between the two modes.

Reseller: The reseller's optimal contract offer to suppliers is to buy each unit at a price of zero—suppliers accept since it meets their opportunity cost, which we have normalized to zero. Suppose R makes the offer to $n \le N$ suppliers, so that it can sell n products to buyers. It then decides on $a_1, \ldots, a_n$ to maximize its expected profit from selling the different products.

The reseller sets $a_1, \ldots, a_n$ together to maximize expected joint profit after observing $\gamma_1, \ldots, \gamma_n$, but

[2] Our main results do not depend on these simplifying features of the model. In particular, we show that they continue to hold both when suppliers have positive bargaining power (see §5.2) and when buyers have bargaining power (see §5.4).

without observing $\delta_1, \ldots, \delta_n$. The reseller's expected profit at stage 2 can be written as

$$\Pi_R(n) = (v-f)\sum_{i=1}^{n} E_R[m-(a_i-(\theta+\gamma_i+\delta_i))^2] - nF. \quad (2)$$

Using the fact that $E_R(\delta_i) = 0$ and taking first-order conditions, we obtain the optimal choice of marketing activities for each product:

$$a_i^R = \theta + \gamma_i. \quad (3)$$

Substituting (3) into (2) and taking expectations, we find that the reseller's expected profit of selling each product is

$$(v-f)(m-V_\delta) - F. \quad (4)$$

Given (1), this is positive, so the reseller offers all N products to obtain the expected profit

$$\Pi_R = N((v-f)(m-V_\delta) - F). \quad (5)$$

Marketplace: In this mode, suppliers maintain control rights over their marketing decisions a_i. Supplier i's expected profit net of the participation fee P, evaluated at stage 2, is

$$\pi_i = (v-f)E_i[m-(a_i-(\theta+\gamma_i+\delta_i))^2] - F - P, \quad (6)$$

where supplier i observes its own δ_i after joining the platform (but not any γ_i or any other δ_j). Using the fact that $E_i(\gamma_i) = 0$ and taking first-order conditions, we obtain the optimal choice of marketing activities for each product

$$a_i^M = \theta + \delta_i. \quad (7)$$

Substituting (7) into (6) and taking expectations, we find that supplier i's expected profit from participating with M is

$$\pi_i = (v-f)(m-V_\gamma) - F - P. \quad (8)$$

The marketplace can set $P = (v-f)(m-V_\gamma) - F$ per supplier, which is positive given (1). It will therefore want to attract all N suppliers to obtain an expected profit of

$$\Pi_M = N((v-f)(m-V_\gamma) - F). \quad (9)$$

Comparing (5) with (9), we obtain the following benchmark result.

Proposition 1. *The M mode is preferred to the R mode if and only if the variance of the suppliers' local information exceeds the variance of the intermediary's local information, i.e., if and only if $V_\delta \geq V_\gamma$.*

The condition above provides a simple benchmark to evaluate reseller-versus-marketplace tradeoffs. Control should be given to the party whose information is more important in terms of how best to design marketing activities. Note that this comparison does not depend on the assumption that m, θ, and F are the same for each product. The result would be identical if these varied across products in some way that was equally observed by suppliers and the intermediary. Our result also does not depend on the assumption that M charges only a fixed participation fee. If M could observe sales and also set a variable fee per unit of sales, this would reduce the supplier's margin from each sale, but not the choice of marketing activities. As a result, the effect would be to just transfer profits from the supplier to M, as with the participation fee.

In Proposition 1 we implicitly assumed that the intermediary has to choose the same mode for all of its products. This assumption is without loss of generality in this benchmark setting, given that the informational advantage (whichever direction it is in) is consistent across products. An intermediary that offers some products directly itself (i.e., in the R mode) and allows independent suppliers to sell other products over its platform (i.e., in the M mode) would do strictly worse whenever $V_\delta \neq V_\gamma$. We explore settings in which such a hybrid mode would be chosen in §4.

3.1. Cross-Product Spillovers

In many real-world settings, marketing activities have cross-product spillovers. This naturally occurs when the different products belong to the same product category. To reflect this in the simplest possible way, suppose higher levels of the marketing choice for one product either increase or decrease the number of buyers for all other products. Assuming that spillovers take a linear form, we find that demand for product i becomes

$$m - (a_i - a_i^*)^2 + x\sum_{j\neq i} a_j,$$

where x is the magnitude of the spillovers.

We allow x to be either negative or positive to accommodate different interpretations. For instance, recall our interpretation of marketing activities a_i as horizontal choices and consider our previous example of Best Buy and TV sets (see §2.1). In this example, allocating a larger amount of signage space to the brand of a particular TV relative to its product features may decrease demand for other products by crowding out consumer attention for other brands or by reducing the positive spillover that would be created by promoting the common product features (e.g., smart TV functionality). Similarly, in the example of store layout, locating products of the same brands close together, rather than close to the complementary products of different brands, would reduce the positive spillovers across complementary products of different brands.

At stage 2, R's profit if it sells n products is

$$\Pi_R(n) = \max_{a_1, a_2, \ldots, a_n} \left\{ (v-f) \sum_{i=1}^{n} E_R \left[m - (a_i - a_i^*)^2 + x \sum_{j \neq i} a_j \right] - nF \right\}.$$

Compared with before, R adjusts its marketing activities for product i to take into account the externality on the $(n-1)$ other products, so

$$a_i^R = \theta + \gamma_i + \frac{x}{2}(n-1).$$

Substituting a_i^R back into profits, the reseller's expected profit from selling n products is

$$\Pi_R(n) = (v-f) \sum_{i=1}^{n} \left(m - V_\delta + x\theta(n-1) + x \sum_{j \neq i} \gamma_j + \frac{x^2(n-1)^2}{4} \right) - nF.$$

Therefore, at stage 1, the expected profit of a reseller selling n products is

$$E[\Pi_R(n)] = n\left((v-f)\left(m - V_\delta + x\theta(n-1) + \frac{x^2(n-1)^2}{4} \right) - F \right).$$

If $x < 0$, then assumption (1) is no longer sufficient to ensure that intermediaries prefer to operate with all N products. We assume instead

$$(v-f)(m - \max(V_\delta, V_\gamma) + x\theta(N-1)) > F, \qquad (10)$$

which requires that x cannot be too negative. Under this assumption, R will want to offer all N products and obtains expected profit

$$\Pi_R = N\left((v-f)\left(m - V_\delta + x\theta(N-1) + \frac{x^2(N-1)^2}{4} \right) - F \right). \qquad (11)$$

By contrast, an individual supplier selling over M obtains an expected profit of

$$\pi_i = (v-f) E_i \left[m - (a_i - a_i^*)^2 + x \sum_{j \neq i} a_j \right] - F,$$

so it ignores the effect of its choice of marketing activities on other suppliers. The result of profit maximization is $a_i^M = \theta + \delta_i$, as before, and so the expected profit for a given supplier deciding whether or not to participate at stage 1 is

$$\pi_i = (v-f)(m - V_\gamma + x\theta(n-1)) - F.$$

Note that an individual supplier's profit depends on how many other suppliers join through the term $x\theta(n-1)$. When $x > 0$, this feature can give rise to multiple equilibria for given participation fees, where more suppliers join if they expect others to join. To address this potential multiplicity of equilibria, we assume here that suppliers hold favorable expectations, meaning suppliers always coordinate on an equilibrium in which all of them join if doing so gives them nonnegative profits in the resulting equilibrium.[3] Again, (10) ensures that M can extract a positive fee from each supplier, and so M will offer all N products even if $x < 0$ and obtain an expected profit of

$$\Pi_M = N((v-f)(m - V_\gamma + x\theta(N-1)) - F). \qquad (12)$$

Comparing (11) and (12), we obtain the following.

Proposition 2. *The M mode is preferred to the R mode if and only if* $V_\delta \geq V_\gamma + (x^2(N-1)^2)/4$.

Introducing spillovers unambiguously shifts the trade-off in favor of the R mode. Thus, the R mode may now be preferred even if $V_\delta > V_\gamma$. This reflects that R takes into account the cross-product externalities from the promotion of product i on other products—something M cannot do if suppliers cannot coordinate their decisions and M cannot condition on suppliers' choices of marketing activity. As a result, the M mode is preferred whenever suppliers' informational advantage in exploiting local information more than offsets the importance of accounting for externalities. Note that the sign of the externality x (i.e., whether spillovers are positive or negative) does not matter in this case—all that matters is its magnitude. Also note that variable fees remain redundant since they do not influence an individual supplier's choice of marketing activities.

3.2. Cost Differences

In this section we focus on the effect of cost differences between R and M. Recall that in the benchmark setting we assumed $F_R = F_M$ and $f_R = f_M$. Consider relaxing these equalities. Equations (5) and (9) become, respectively,

$$\Pi_R = N((v - f_R)(m - V_\delta) - F_R) \quad \text{and}$$
$$\Pi_M = N((v - f_M)(m - V_\gamma) - F_M).$$

Given (1), both expressions are positive. We obtain the following.

[3] The case in which suppliers hold unfavorable expectations is analyzed in §3.3. See Footnote 4.

Proposition 3. *The M mode is preferred to the R mode if and only if*

$$V_\delta \geq V_\gamma + \frac{(m - V_\gamma)(f_M - f_R) + F_M - F_R}{v - f_R}. \qquad (13)$$

If $f_M > f_R$ (respectively, $f_M < f_R$), then the M mode is relatively more profitable when m is low (respectively, when m is high).

If both cost differences go in the same direction (i.e., $f_M - f_R$ and $F_M - F_R$ have the same sign), then the baseline trade-off is unambiguously tilted in the direction of the lower-cost mode. On the other hand, if the fixed and variable cost differences go in opposite directions (i.e., $f_M - f_R$ and $F_M - F_R$ have opposite signs), then the effect of cost differences on the benchmark trade-off is ambiguous. It depends on the magnitude of fixed cost savings relative to the magnitude of variable cost savings and whether m is high (i.e., "short-tail," or popular, products) or if m is low (i.e., "long-tail," or unpopular, products). We explore the implications of this result for explaining why some products are offered in M mode and some in R mode in §4.3.

3.3. Network Effects with Unfavorable Expectations

We have previously assumed that the number of buyers for each supplier does not depend on how many suppliers the buyer can purchase from. If buyers are more likely to come to an intermediary with more suppliers present (or offering more products), then suppliers' expectations can matter. To capture a possible cross-group network effect between suppliers and buyers, suppose m increases in n. This could arise because the more products are made available, the more buyers will become aware of the intermediary (e.g., through word of mouth, reputation effects, or other sources of information and review) or the more likely a given buyer who is informed about a particular product available through the intermediary will be to find other products of interest through the intermediary. In other words, we allow for positive agglomeration effects, contained in $m(n)$. We normalize $m \equiv m(N)$. To ensure that M is always profitable, we add to (1) the new assumption that

$$(v - f)(m(1) - V_\gamma) > F. \qquad (14)$$

The previous analysis remains valid in the presence of this network effect, provided that M benefits from favorable expectations; i.e., suppliers always coordinate on joining if they make nonnegative profits in the resulting equilibrium. Since m is increasing in n, the marketplace wants to sign up all N suppliers. It charges them a participation fee equal to their expected profit (8), which assumes that each expects all other suppliers to join when facing this fee. Note that R's problem is also unaffected. Suppliers do not need to form expectations of how many other suppliers join when deciding whether or not to sell to R, since whether it is profitable to do so is independent of how many buyers show up.

Let us now examine the case in which suppliers hold unfavorable expectations; i.e., they coordinate on not joining the marketplace whenever this is an equilibrium. This scenario is particularly relevant for marketplaces that are part of early-stage ventures. Our treatment of unfavorable expectations follows Caillaud and Jullien (2003), Hagiu and Spulber (2013), and Halaburda and Yehezkel (2013).

The optimal choices of marketing by suppliers are unchanged compared to those in §3 because individual suppliers do not take into account the number of other suppliers that join when choosing their marketing activities. Thus, each individual supplier's expected net profit from joining M when it expects $n^e \geq 0$ other suppliers to join is $(v - f) \cdot (m(n^e + 1) - V_\gamma) - F - P$, where P is the participation fee charged by M. We denote this profit as $\pi(n^e + 1) - P$. Note that n^e depends on P: we have chosen not to write $n^e(P)$ in order to avoid clutter. When suppliers hold unfavorable expectations, for any given P, each supplier expects no other supplier to join whenever this is an equilibrium, i.e., whenever $\pi(1) - P \leq 0$. In this case, if M charges $P > \pi(1)$, then there is an equilibrium in which no suppliers join: each supplier expects no other suppliers to join, which implies that a supplier would make negative profits if that supplier were to join alone. Since this equilibrium prevails under unfavorable expectations, M does not wish to set $P > \pi(1)$. Thus, the maximum price that M can charge so that suppliers join is $P = \pi(1)$. At this price, the only equilibrium is that all N suppliers offered the contract join, because they are willing to join irrespective of what they expect other suppliers to do. Given this, they must rationally expect all other suppliers to join when this participation fee is charged. The profit extracted by M is therefore $N\pi(1)$, which is equal to

$$\Pi_M = N((v - f)(m(1) - V_\gamma) - F). \qquad (15)$$

Note that (15) is less than (9) given that m is increasing in n, so that unfavorable expectations lower M's profit. Assumption (14) ensures that M still prefers to attract all N suppliers. Comparing (15) with (5), we have the following.

Proposition 4. *When m is increasing in n and the intermediary faces unfavorable expectations, the M mode is preferred to the R mode if and only if*

$$V_\delta \geq V_\gamma + m(N) - m(1). \qquad (16)$$

Unfavorable expectations shift the trade-off unambiguously in favor of the R mode, which may now be preferred even when the local information of individual suppliers is more important. The additional term on the right-hand side of the inequality captures the size of the network effect. The R mode allows the intermediary to sidestep the unfavorable expectations problem that the M mode can encounter.[4]

There are two ways for M to mitigate the problem arising from network effects and unfavorable expectations. One is to offer some products under the R mode, an option we analyze in §4. The other option is to charge a variable fee per unit of sales (if it can observe supplier sales). This can eliminate the need to set a fixed participation fee and so reduces the role of network effects. In fact, if M can pay suppliers to join, then it can completely overcome unfavorable expectations by subsidizing the suppliers' fixed participation costs and extracting all of their rents through variable fees. This leads to (almost) the same profits as under favorable expectations. Such subsidies may, however, not be feasible—for instance, because they could lead to an adverse selection problem in which firms that are not genuine suppliers join simply to collect the subsidy. In Appendix A we prove the following.

Proposition 5. *When m is increasing in n, the intermediary faces unfavorable expectations, the marketplace can observe and condition on suppliers' sales but cannot subsidize suppliers to join the marketplace, and the M mode is preferred to the R mode if and only if*

$$V_\delta \geq V_\gamma + \rho(m(N) - m(1)), \tag{17}$$

where

$$\rho = \frac{F}{(v-f)(m(1) - V_\gamma)} \in (0, 1).$$

Comparing (17) with (16), we observe that the effect of network effects is dampened by the multiplying factor ρ that lies strictly between 0 and 1. Thus, although the intermediary's choice is still unambiguously tilted toward the R mode in the face of network effects and unfavorable expectations, variable fees do help to mitigate the effect.

[4] Using the same approach, we can derive the equilibrium under unfavorable expectations for the setting in §3.1, in which m is constant and $x > 0$. If suppliers hold unfavorable expectations, the marketplace can charge at most $P = \pi(1) = (v - f)(m - V_\gamma) - F$. Comparing this with the profits of a reseller, which are unchanged, the M mode is preferred if and only if $V_\delta \geq V_\gamma + x\theta(N-1) + x^2(N-1)^2/4$. Since $x > 0$, unfavorable expectations once again tilt the decision in favor of the R mode, but the trade-off remains otherwise the same.

4. Hybrid Modes

So far, we have focused on an intermediary that has to choose between the M mode and the R mode. In §3 we noted that an intermediary that could offer some products under each mode would not want to do so. In reality, intermediaries that sell products using both modes are quite prevalent. Amazon is a prominent example. As discussed in §1, Best Buy and department stores are other examples. In the sections that follow, we highlight several key factors that can make a hybrid mode optimal.

4.1. Heterogeneous Information

In our benchmark model, we have assumed that the variances of supplier and intermediary information are the same for all products. Suppose instead that they are different, such that for all $i \in S_R \subset [N] \equiv \{1, \ldots, N\}$, we have $\mathrm{Var}(\gamma_i) > \mathrm{Var}(\delta_i)$, and for all $i \in S_M = [N] \backslash S_R$, we have $\mathrm{Var}(\gamma_i) < \mathrm{Var}(\delta_i)$. It is then straightforward to see the following.

Proposition 6. *The intermediary's optimal strategy is to offer all products $i \in S_R$ in the R mode and all products $i \in S_M$ in the M mode.*

In other words, the intermediary should use the R mode for all products where it has an information advantage over suppliers and the M mode for all products where the advantage lies with suppliers.

4.2. Heterogeneous Spillovers

As we have seen, spillovers across products unambiguously shift the basic trade-off in favor of the R mode. If all spillovers are the same as we assumed in §3.1, then the optimal model is still either a pure reseller or a pure marketplace. In reality, spillovers may be asymmetric; i.e., some products generate larger spillovers than others. In such scenarios, if suppliers' information is more important than reseller information, it may be optimal to have some products offered in the M mode (those products for which marketing does not generate any systematic and significant spillovers) and others offered in the R mode (those products for which marketing generates a consistent and important spillover in one direction).

To illustrate, suppose that there exists a partition of $[N]$ into two sets S_R and $S_M = [N] \backslash S_R$, such that all products $i \in S_R$ generate spillovers equal to x among each other but no spillovers on products $i \in S_M$, and products $i \in S_M$ generate no spillovers whatsoever. Then the profits of the intermediary can be decomposed into the two sets of products, with the profits being separable across the two groups. Thus, Proposition 2 applies to the group of products in S_R, and Proposition 1 applies to the group of products in S_M. We obtain the following.

Proposition 7. *Suppose all products $i \in S_R$ generate spillovers equal to x on each other, whereas products $i \in S_M$ do not generate or receive any spillovers. The intermediary chooses the interior hybrid mode in which it offers products $i \in S_R$ under the R mode and products $i \in S_M$ under the M mode if and only if*

$$V_\gamma < V_\delta \le V_\gamma + \frac{(N_R-1)^2 x^2}{4}.$$

Otherwise, if $V_\delta \le V_\gamma$, then the intermediary chooses the pure R mode; if $V_\delta > V_\gamma + (N_R-1)^2x^2/4$, then the intermediary chooses the pure M mode.

Clearly, the pure R mode dominates if $V_\delta \le V_\gamma$. Not only does R have an information advantage for all products, but it can fully internalize the effect of the spillovers between products in S_R. If $V_\delta > V_\gamma$, then the information advantage rests with the suppliers, so the M mode is preferred for those products in S_M for which there are no spillovers. If V_δ is sufficiently high, this information advantage will more than offset the benefit of coordinating marketing activities, and the intermediary will prefer the M mode even for the products in S_R.

A more interesting case arises if the spillovers generated from products in S_R extend to all products. In this case, even if the intermediary controls all products in S_R under the R mode, it will still not internalize all the spillovers they create. There can then be a role for offering some additional products (i.e., some from S_M) in the R mode. In Appendix A we prove the following.

Proposition 8. *Suppose all products $i \in S_R$ generate spillovers equal to x on all other products, whereas products $i \in S_M$ do not generate any spillovers. Assume $N_R^2 + N_R > 2N - 1$. Then the optimal mode is as follows:*

- *pure R mode if $V_\delta - V_\gamma \le (x^2/4)N_R$;*
- *a hybrid mode, in which N_R products in S_R and k^* products in S_M are sold under the R mode and all other products are sold under the M mode if $(x^2/4)N_R \le V_\delta - V_\gamma \le (x^2/4)(1 - N_R^2 + 2N(N_R-1))$, where $k^* \in [1, N - N_R - 1]$ satisfies the following bounds:*

$$(N-N_R) - \frac{2(V_\delta - V_\gamma)}{N_R x^2} - \frac{1}{2} < k^* < (N-N_R) - \frac{2(V_\delta - V_\gamma)}{N_R x^2} + \frac{1}{2}; \quad (18)$$

or

- *pure M mode if $V_\delta - V_\gamma \ge (x^2/4)(1 - N_R^2 + 2N \cdot (N_R - 1))$.*

Once again, the pure R mode dominates if $V_\delta \le V_\gamma$. In case $V_\delta > V_\gamma$, the intermediary now faces a tradeoff. Suppliers within S_M enjoy an information advantage, but, by taking control of some products from S_M, the intermediary can better internalize the spillovers generated by the marketing choices of products in S_R. This also raises the amount that independent suppliers are willing to pay to join, given that the marketing activities of products in S_R are better optimized in terms of the spillovers they create.

4.3. Heterogeneous Products and Cost Differences

Suppose that the value of m differs across products so that $m_1 \le m_2 \le \cdots \le m_N$ with at least one inequality strict. Some products are long-tail products (have low m_i), and some products are short-tail products (have high m_i). Furthermore, assume that there are cost differences as in §3.2. Then the profit that the intermediary obtains from product i if it operates in the R mode is $(v - f_R)(m_i - V_\delta) - F_R$. Given that M is allowed to set different participation fees for the different products to reflect the different values of m, the profit that the intermediary obtains from product i if it operates in the M mode is $(v - f_M)(m_i - V_\gamma) - F_M$. Then we observe the following.

Proposition 9. *If $f_M > f_R$ (respectively, $f_M < f_R$), then the intermediary's optimal strategy is to offer products i such that $m_i \le m^*$ in the M mode (respectively, R mode) and products i such that $m_i > m^*$ in the R mode (respectively, M mode), where the cutoff m^* is given by*

$$m^* = \frac{V_\delta(v - f_R) - V_\gamma(v - f_M) + F_R - F_M}{f_M - f_R}.$$

In other words, when the marketplace has a variable cost disadvantage (i.e., when $f_M > f_R$), an intermediary facing heterogeneous product demands should sell long-tail products in the M mode and short-tail products in the R mode, and vice versa when the marketplace has a variable cost advantage. We discuss empirical implications of and evidence for this result in §6.

4.4. Unfavorable Expectations

Suppose, as in §3.3, that m is increasing in n; i.e., there are network effects. In this case, the presence of unfavorable expectations creates a natural reason for the intermediary to choose a hybrid strategy: offer a sufficient number of products under the R mode in order to overcome unfavorable expectations, but not too many if suppliers' local information is more important than the intermediary's.

Suppose that the intermediary offers $0 \le n_R \le N$ products under the R mode and $(N - n_R)$ products under the M mode. Unfavorable expectations means that independent suppliers expect that the intermediary will only be able to offer the n_R products it has bought as a reseller whenever it is an equilibrium for the independent suppliers not to affiliate (i.e., when their surplus is negative if they each assume all the other independent suppliers do not affiliate). Thus, the amount that the intermediary can extract from independent suppliers (if $n_R < N$) is

$$(N - n_R)((v - f)(m(n_R + 1) - V_\gamma) - F).$$

Its profit from selling the remaining n_R products itself is

$$n_R((v - f)(m(N) - V_\delta) - F).$$

Adding the two components of profit, the intermediary's expected profit is

$$\Pi(n_R) = (v - f)((N - n_R)m(n_R + 1) + n_R m(N) - (N - n_R)V_\gamma - n_R V_\delta) - nF. \quad (19)$$

Since $m(N) > m(n_R + 1)$ and since $m(n_R + 1)$ is increasing in n_R for $n_R < N - 1$, the term $(N - n_R)m(n_R + 1) + n_R m(N)$ in (19) is unambiguously increasing in n_R up to $n_R = N - 1$. This represents the fact that the R mode allows the intermediary to avoid unfavorable expectations, so shifting more products to this mode increases profit. By itself, this term would push the intermediary to offer all products in the R mode.[5] However, if $V_\delta > V_\gamma$, then the term $-(N - n_R)V_\gamma - n_R V_\delta$ in (19) is decreasing in n_R. This is due to the informational advantage of suppliers in the M mode. Thus, there can be a trade-off. Offering more products in the R mode helps to overcome unfavorable expectations, but it loses valuable supplier information. The following proposition is proven in Appendix A.

Proposition 10. *Suppose that $m(n_K) = m - \alpha(N - n_K)$ for $1 \le n_K \le N$, with $\alpha > 0$. If $V_\delta \le V_\gamma$, then the intermediary will choose to offer all products in the R mode. If $V_\gamma < V_\delta < V_\gamma + 2\alpha(N - 1)$, the intermediary will adopt a hybrid mode. If $V_\delta \ge V_\gamma + 2\alpha(N - 1)$, the intermediary will offer all products in the M mode. In the case that the intermediary adopts the hybrid solution, the optimal number of products n_R^* offered in the R mode is bounded by the inequalities*

$$N - 1 - \frac{V_\delta - V_\gamma}{2\alpha} < n_R^* < N - \frac{V_\delta - V_\gamma}{2\alpha}. \quad (20)$$

If $V_\delta \le V_\gamma$, then the R mode dominates both on informational grounds and as a way to overcome unfavorable expectations. When $V_\delta > V_\gamma$, offering $N - 1$ products in the R mode fully overcomes pessimistic expectations, leaving 1 product to be offered in the M mode to exploit the information advantage suppliers have in this case. Of course, once V_δ is sufficiently large relative to V_γ, it is optimal to offer all products in the M mode. Note that the bounds in (20) for the optimum number of products sold in the R mode are decreasing in $V_\delta - V_\gamma$ (consistent with an informational advantage driving the choice between the two modes) and increasing in the magnitude of network effects α (consistent with the finding of §3.3 that network effects are detrimental to the M mode under unfavorable expectations).

5. Robustness

In this section we discuss the implications of some modifications to our setup, which are meant to highlight the robustness and general nature of the insights we have drawn.

5.1. Costly Marketing Activities

Consider an alternative formulation of marketing activities. Rather than representing them as horizontal choices, we now assume that marketing activities a_i represent the actual levels of investment in marketing through or on the intermediary, and that the marginal effectiveness of marketing activities is proportional to a_i^*. Specifically, demand for product i is

$$m + 2(\theta + \gamma_i + \delta_i)a_i,$$

where θ, γ_i, and δ_i satisfy the same assumptions as before.[6] Investing a_i in marketing activities implies a cost κa_i^2, which is incurred by the supplier (M mode) or by the intermediary (R mode). Thus, additional spending on marketing activities increases demand, although with diminishing returns. We have in mind costly activities that bring in additional buyers by making them more aware of the product being marketed. The assumption of private information captures the possibility that suppliers and intermediaries may each have some information about how effective spending on marketing activities will be for a given product. In Appendix B we show that our main results from §3 carry through with this alternative specification.

5.2. Supplier Bargaining Power

Up to now, we have assumed the intermediary held all the bargaining power: it made take-it-or-leave-it offers to suppliers in stage 1 and extracted their entire expected surplus under both modes. It is straightforward to extend our model to scenarios in which suppliers have positive bargaining power. Suppose, consistent with our timing of offers, that bargaining occurs in stage 1. To do so, suppose that suppliers have bargaining power $\beta \in [0, 1]$, meaning that each supplier will only be agreeable to deal with the intermediary if the supplier retains a fraction β of the

[5] Note that selling $N - 1$ products in the R mode and 1 in the M mode would be equivalent to selling all N in the R mode from the perspective of overcoming unfavorable expectations.

[6] The constant 2 normalizes the marginal effectiveness of a_i to be the same as in our benchmark specification.

expected joint profit it generates, with the remaining fraction $(1-\beta)$ retained by the intermediary. This could either be done by reducing the participation fee charged by the marketplace or by making a fixed payment to the supplier in the case of a reseller (or equivalently, by increasing the wholesale price paid to the supplier).

In Appendix B we show that, once again, our main results from §3 carry through. In particular, Propositions 1–3 are unchanged. The analysis corresponding to Propositions 4 and 5 is somewhat modified, but the key results remain the same. The only difference is that, when supplier bargaining power is above a certain threshold, the effect of unfavorable expectations disappears completely and the benchmark trade-off from Proposition 1 is restored. The explanation is as follows: if supplier bargaining power is sufficiently strong, then the participation fees charged to suppliers are low anyway so that all suppliers want to participate regardless of their expectations about what other suppliers will do. In this case, the nature of expectations is no longer relevant to the trade-off between the two modes.

5.3. Downward-Sloping Demand from Suppliers

We have assumed that in the absence of network effects, both M and R can extract the entire expected surplus from suppliers. This was either because suppliers (and their products) were completely symmetric or, where they were not, because we implicitly assumed that intermediaries (M in particular) could price discriminate; i.e., M could observe any heterogeneity across suppliers and set different participation fees accordingly.

It is straightforward to extend our model to accommodate heterogeneity across products, such that the heterogeneous parameter (e.g., different m_i values across products) is unobservable by the intermediary. In this case, the intermediary would be unable to extract the full supplier surplus and would therefore face a supplier demand for participation that is downward sloping in the price(s) charged (under both modes). As long as the heterogeneous parameter does not affect marketing activities (for instance, heterogeneity in m has no bearing on the choices of marketing activities), our main results and conclusions remain unchanged. In Appendix B we provide a brief illustration of this point with heterogeneous m.

5.4. Buyer Surplus and Affiliation

We have assumed that buyer affiliation with the intermediary was costless and that the intermediary and/or the suppliers were able to extract the entire buyer surplus in all scenarios. These features of our model allowed us to avoid introducing any pricing distortions in the analysis. Our model can, however, be extended such that (i) buyers incur heterogeneous opportunity costs when joining the intermediary (either M or R), and (ii) buyers have positive bargaining power, which allows them to retain some surplus from their transactions with R or the individual suppliers. In particular, we can allow R to have greater (or equal) bargaining power over buyers relative to individual suppliers. This fits real-world scenarios in which R aggregates the bargaining powers of many individual suppliers, such as Intellectual Ventures, for example, in the market for patents (see Hagiu and Wright 2013, Hagiu and Yoffie 2013).

It is straightforward to show that in this context our main trade-offs remain unchanged. The benchmark trade-off is simply augmented by terms that reflect the new differences between M and R—namely, that the R mode allows the intermediary to extract more rents from buyers, but, for this exact reason, the M mode attracts a larger number of buyers, because they expect to obtain a larger net surplus. The formalization of these results is contained in Appendix B.

5.5. Other Noncontractible Decision Variables

Throughout the paper, we have chosen to focus on marketing activities as the key noncontractible decision driving the difference between the two modes. As discussed in §1, however, there are other potentially noncontractible decisions that one could focus on. For example, if there are privately observed demand shocks, similar trade-offs to those we have derived will arise when the noncontractible decisions are product prices rather than marketing activities. Consider the simplest possible setting. Suppose that each supplier offers a single product and is subject to linear demand and that all variable costs are set to zero. The level of demand for each product is subject to two demand shocks, one of which is observed only by the corresponding supplier and one of which is observed only by R. For this case, one can show that essentially the same trade-offs arise as in our benchmark model. The extent to which the M mode is preferred over the R mode boils down to whether the local information on demand by suppliers is more important (has higher variance) than the local information of the intermediary. In the case that products are independent, the trade-off is in fact identical to our benchmark result in Proposition 1. Relative to this, the choice is shifted toward the R mode to the extent that there is a spillover in demand, which will be the case if products are substitutes or complements. This shows that the result of Proposition 2 continues to apply. The formalization of these results is contained in Appendix B.

6. Empirical Implications

In this section we discuss some empirical illustrations of and evidence for our main results.

Consider our baseline result from Proposition 1 and its extension to the case with heterogeneous information in Proposition 6: the marketplace mode is preferred to the reseller mode whenever the local information held by suppliers is more important than the local information held by the reseller. Three real-world examples illustrate this result: Amazon with respect to books and electronics, department stores, and Best Buy.

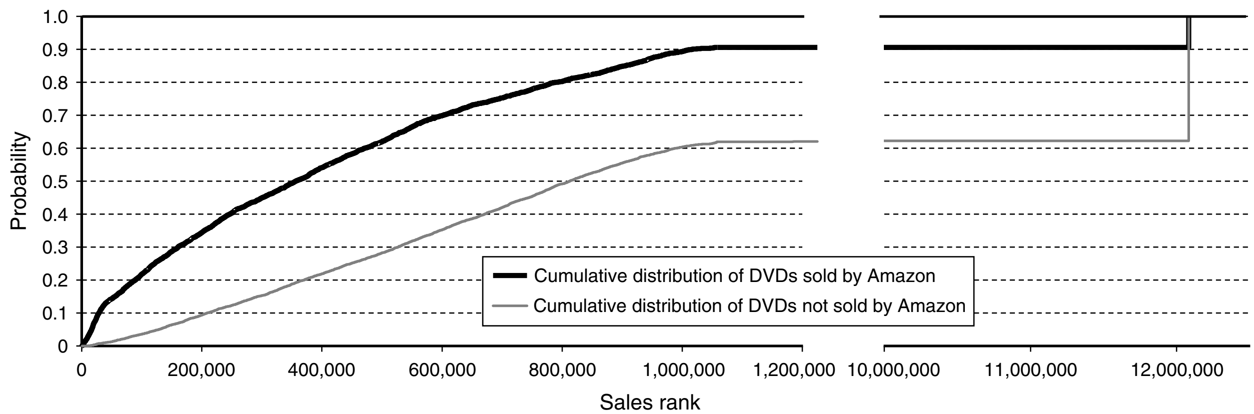
- Amazon started in 1994 as a reseller of books; it added the electronics category in 1999. Furthermore, the products under the electronics category change notoriously fast. As a result, Amazon likely has more of an information disadvantage relative to its suppliers with respect to electronics than with respect to books. We therefore expect that Amazon should sell a lower proportion of the electronics category as a reseller relative to the books category. High-level data gleaned from Amazon's website confirm this prediction. In January 2014, under the category "Books," Amazon listed 20,468,847 new books in stock. Amazon is listed as a seller for 11,007,702 of these, so over 50%. Under the category "Electronics," Amazon listed 25,851,049 new items in stock. Amazon is listed as a seller for only 357,283 of these, so just over 1%.
- Department stores have traditionally offered cosmetics products through dedicated "counters" where displays are designed and controlled by individual brands (and sales staff are assigned exclusively to and trained by specific brands) as in the *M* mode, whereas other products (e.g., mass-market accessories such as watches, scarves, and jewelry) are offered on displays controlled by the store and serviced by generalist sales personnel as in the *R* mode. Koehn (2002) provides an explanation for this practice that is consistent with our model's predictions: cosmetics brands have highly specialized knowledge about how best to market specific products to consumers, which is hard for stores and their sales staff to accumulate. We do not have any direct evidence for the case of mass-market accessories, but specialized knowledge is likely less important for such products.
- Similarly, whereas many electronics manufacturers are content to let Best Buy control the sale of their products to consumers, Apple, Microsoft, and Samsung have recently decided to run their own ministores within Best Buy. Although we do not have any direct information about the factors that led to these arrangements, it is reasonable to speculate that they are at least in part driven by the realization that branded manufacturers have superior information on how best to pitch their products to consumers. Finally, this trade-off is likely also relevant in explaining why some digital content intermediaries such as Amazon's Kindle Store, Apple's iBooks Store, Apple's App Store, and Google Play have adopted the marketplace mode, in which content or application suppliers control pricing, end-user licensing, and customer support.

Let us now turn to the three other key factors that affect the baseline trade-off. First, if marketing activities (or other noncontractible decisions) generate spillovers across products, the reseller mode becomes more attractive (see Propositions 2 and 7). This is because a reseller can internalize these externalities when it exerts its control rights—something that independent suppliers acting in an uncoordinated fashion cannot do. Thus, it would probably not make sense for Best Buy to allow all of its suppliers to operate independent ministores. Indeed, given the inherent competition among brands for consumer attention, the result would likely be an overinvestment in brand-specific promotional activities (signage, sales staff, etc.). Furthermore, spillovers are likely an important factor in explaining why cable TV operators predominately choose to operate in the reseller mode, extracting more value by coordinating their pricing and marketing decisions across different channels (e.g., through bundling and the cross marketing of different channels).

Second, Propositions 3 and 9 imply that when the reseller has lower marginal costs of handling additional sales of the same product than the marketplace, the trade-off between the two modes depends on the level of demand for each product. The baseline trade-off is shifted in favor of the marketplace when the intermediary handles a broad range of long-tail products (e.g., eBay, Etsy, the Flea Market of Saint-Ouen in Paris) and in favor of the reseller when the intermediary is considering a more focused range of short-tail products (e.g., Eastbay, an online retailer focused mainly on athletic shoes; Gazelle, an online service that buys and resells used smartphones and tablets, focusing only on the most popular models).

To specifically illustrate the result in Proposition 9, consider the example of Amazon. Thanks to its massive infrastructure investments, Amazon has lower variable costs of handling and marketing any given product on its site than third-party merchants. Therefore, our model predicts that Amazon should sell short-tail products under the *R* mode and long-tail products under the *M* mode. This prediction is consistent with descriptions of Amazon's strategy with respect to third-party sellers. Amazon often enters new product categories by allowing third-party merchants to sell the products in question (marketplace mode). If a product category becomes successful (i.e., if sales exceed a certain threshold), then Amazon starts selling the relevant products in the reseller mode (see Stone 2013, pp. 303–304). In other words,

Figure 1 **CDFs of Sales Rank for DVDs Sold by Amazon and Those Not Sold by Amazon**



once Amazon reaches information parity with its sellers, it switches to the reseller mode in order to exploit its scale advantage.

We have tested this prediction more rigorously using data from Amazon. We extracted the unique product identifiers and Amazon's sales ranks in the category "Movies and TV" for all 583,779 DVDs listed by Amazon under "Movies and TV" that were in stock in early January 2014.[7] Amazon does not disclose exactly how it measures sales rank, but it is widely understood that it is a relative measure of the popularity of items within a given product category (in this case, "Movies and TV") based on their recent and past sales history. High-selling items have low rankings (i.e., closer to number one) whereas items that seldom sell having rankings that can be in the millions. We randomly drew 10,000 product identifiers, and for each of them we recorded whether or not Amazon sold that DVD. Amazon was listed as a seller for 35.74% of these DVDs. Of the 10,000 sampled DVDs, 2,759 did not have a sales rank, reflecting that they had not had any recent sales on Amazon. Amazon was listed as a seller for only 12.11% of these 2,759 DVDs, a strong indication that it avoids trying to sell long-tail (unpopular) items.

When we included data on items with no sales rank, we set their sales rank equal to 1 plus the maximum of the reported sales ranks over the 583,779 DVDs in order to capture that they are less popular than the least popular item with recent sales. Measured in this way, the median sales rank for those DVDs where Amazon is listed as a seller is 355,793. This compares to a median sales rank of 812,332 for DVDs where Amazon is not listed. Even if we drop items with no sales rank, the median sales rank for those DVDs where Amazon is listed as a seller is 304,499, compared to a median sales rank of 540,572 for DVDs where Amazon is not listed. Regardless of how sales ranks are treated, a two-sided Wilcoxon test of the null hypothesis that two groups (sold by Amazon and not sold by Amazon) have identical distribution functions against the alternative hypothesis that the two distribution functions differ in their median easily rejects the null hypothesis in favor of the alternative that the group in which Amazon sells has lower sales ranks (i.e., more popular products).[8]

Figure 1 plots the cumulative distribution function (CDF) of sales ranks (i.e., the probability that sales rank is less than any given number) for each of the two groups. It shows clearly that the DVDs sold by Amazon take up a much higher proportion of the very popular DVDs and a much lower proportion of the DVDs with no sales or those that are very unpopular (as indicated by their sales ranks).

The third key factor we explored was network effects. Specifically, if more suppliers attract more buyers per supplier, and the marketplace faces unfavorable expectations (a common occurrence for early-stage marketplace ventures), then the baseline tradeoff is shifted in favor of the reseller. Indeed, operating as a reseller allows the intermediary to sidestep the chicken-and-egg problem that plagues early-stage marketplaces. Thus, our model predicts that, when starting up, intermediaries should consider adopting the reseller mode, given that they are more likely to face a problem of unfavorable expectations initially. Once they overcome such unfavorable expectations, they can switch to the marketplace mode. Consequently, our analysis formalizes the discussion of two-sided platforms' start-up strategies in Hagiu and Eisenmann (2007).

[7] Since Amazon only listed the top 9,600 items on any search, this required collecting the information by conducting searches in narrow price ranges. All items can be obtained by combining the results of these different searches.

[8] The p-values are less than 2.2e-16 in both cases, so essentially zero. Note that the Wilcoxon rank-sum test is particularly suitable for this exercise since it is robust to rank data of the type we use here.

7. Conclusions and Managerial Implications

We have established several fundamental trade-offs faced by an intermediary when choosing whether to function more as a marketplace or more as a reseller. We have also discussed some empirical implications of these trade-offs. Our model's predictions have clear managerial implications. To summarize, intermediaries should choose the marketplace (respectively, reseller) mode for the following types of products: (1) products for which suppliers have a significant (respectively, a small) information advantage about the best way to market products relative to the intermediary, (2) products whose prices and marketing activities have limited (respectively, large) spillovers on other products, (3) long-tail (respectively, short-tail) products when the marketplace mode has a marginal cost disadvantage (respectively, advantage), and (4) products provided by late-stage (respectively, early-stage) ventures. These implications not only apply to an intermediary choosing between positioning itself as a pure reseller or a pure marketplace but also to hybrid modes in which the intermediary needs to determine how many products (and, in the case of heterogeneous products, which products) to offer in each mode.

Our analysis has provided a new style of modeling intermediaries' strategic positioning decisions. There are many promising directions in which this analysis can be extended. One could generalize our analysis to allow for multiple noncontractible decisions, such as different types of marketing activities, store design, customer service, inventory management, returns management, aftersale service, delivery options, pricing, payment, etc. We could allow the intermediary to take control of some of these decisions and not others. If different decision variables have different distributions of supplier and intermediary information, and different degrees of spillovers associated with them, then it is quite possible that a different type of hybrid mode would arise, with the intermediary controlling some decisions and leaving others for suppliers to control. Considering all possible combinations of the allocation of control rights over these different decisions would map out a fine-grained spectrum of models, from a pure marketplace in which all decisions are controlled by suppliers to a pure reseller in which all are controlled by the intermediary.

Another important direction for future research is to relax the assumption that buyers must go through the intermediary in order to reach suppliers. This need not be the case. The possibility of disintermediation may be of particular concern under the marketplace mode given that suppliers and buyers get to interact directly, thereby constraining the level (and type) of fees that the marketplace can charge and shifting an intermediary's choice toward the reseller mode. Related to this point, one could embed the choice of intermediation mode into a framework in which the intermediary arises endogenously, in response to some friction (e.g., search costs or transaction costs) from direct trading between suppliers and buyers. Finally, one could study competing intermediaries and whether there is a tendency for different intermediation modes to emerge, possibly in a complementary relationship, or for one mode to drive out the other. Where different modes do emerge, they could appeal to different types of suppliers and buyers, and it would be interesting to study which types of suppliers and buyers are attracted to each mode.

Supplemental Material

Supplemental material to this paper is available at http://dx.doi.org/10.1287/mnsc.2014.2042.

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Appendix A. Proofs

Proof of Proposition 5. If M can monitor supplier sales and charge a variable fee p in addition to a nonnegative fixed fee P, each individual supplier's expected profit from joining M is $(v-p-f)(m(n^e)-V_\gamma)-F-P$. Under unfavorable expectations, $P(p)=(v-p-f)(m(1)-V_\gamma)-F$, implying that M's expected profit is

$$\begin{aligned}\Pi_M^{UE}(p,n) &= n(P(p)+p(m(n)-V_\gamma))\\ &= n((v-f)(m(1)-V_\gamma)+p(m(n)-m(1))-F)\end{aligned}$$

if n suppliers participate. Given $m(n)>m(1)$, $\Pi_M^{UE}(p,n)$ is strictly increasing in p provided that $v-p-f>0$, so that the supplier still wants to sell units and to choose the optimal level of marketing activities. Then M optimally sets the highest possible p such that $P\geq 0$. This is

$$p = v-f-\frac{F}{m(1)-V_\gamma}.$$

Note that $0<p<v-f$, given (14). At this price p, profits are clearly increasing in n, so M optimally sets $n=N$. Its expected profit is

$$N\left((v-f)(m(N)-V_\gamma)-\frac{m(N)-V_\gamma}{m(1)-V_\gamma}F\right),$$

which can be compared to R's expected profit in (5). The comparison gives the expression in (17). The term ρ in (17) satisfies $0<\rho<1$ given (14). □

Proof of Proposition 8. First, note that it is never optimal to sell any product $i\in S_M$ in the R mode if there is at least one product $j\in S_R$ sold in the M mode. Indeed, one could then profitably switch product i to the M mode and product j to the R mode. The only impact on profit would arise from the fact that marketing for j creates spillovers that the R mode internalizes whereas the M mode does not. This implies that the intermediary should consider selling some products from S_M in the R mode only if all products in S_R are sold in the R mode.

Second, we show it is never optimal to sell some, but not all, products from S_R in the M mode. Let S_0 denote the set of $k\le N_R$ products within S_R that are sold under the M mode. Then, for all $i\in S_0$, the optimal choice of marketing is $a_i=\theta+\gamma_i+x(N_R-k-1)/2$. For all other j, the choice of marketing is $a_j=\theta+\delta_j$. Resulting intermediary profits are

$$\begin{aligned}\Pi(k) &= (v-f)\sum_{i\in S_R\setminus S_0}E\biggl[m-\biggl(\frac{x(N_R-k-1)}{2}-\delta_i\biggr)^2\\&\quad+x\biggl(\sum_{j\neq i,\,j\in S_R\setminus S_0}\biggl(\theta+\gamma_j+\frac{x(N_R-k-1)}{2}\biggr)+\sum_{j\in S_0}(\theta+\delta_j)\biggr)\biggr]\\&\quad+(v-f)\sum_{i\in S_0}E\biggl[m-\gamma_i^2+x\biggl(\sum_{j\in S_R\setminus S_0}\biggl(\theta+\gamma_j\\&\quad+\frac{x(N_R-k-1)}{2}\biggr)+\sum_{j\neq i,\,j\in S_0}(\theta+\delta_j)\biggr)\biggr]\\&\quad\cdot(v-f)\sum_{i\in S_M}E\biggl[m-\gamma_i^2+x\biggl(\sum_{j\in S_R\setminus S_0}\biggl(\theta+\gamma_j\\&\quad+\frac{x(N_R-k-1)}{2}\biggr)+\sum_{j\in S_0}(\theta+\delta_j)\biggr)\biggr]-NF\\&=(v-f)\biggl((N_R-k)\biggl(V_\gamma-V_\delta-\frac{x^2((N_R-k)^2-1)}{4}\biggr)-xN_R\theta\\&\quad+N\biggl(m-V_\gamma+xN_R\theta+\frac{x^2(N_R-k)(N_R-k-1)}{2}\biggr)\biggr)-NF.\end{aligned}$$

This expression is valid for $0\le k\le N_R$.

Suppose that there exists $k\in[1,N_R-1]$ such that $\Pi(k)\ge\Pi(0)$ and $\Pi(k)\ge\Pi(N_R)$. These two inequalities are equivalent to

$$V_\delta-V_\gamma\ge\frac{x^2}{4}(2N(2N_R-k-1)+3N_Rk-3N_R^2-k^2+1)\quad\text{and}$$
$$V_\delta-V_\gamma\le\frac{x^2}{4}(N_R-k-1)(2N-1-(N_R-k)),$$

respectively. For both inequalities to hold requires $2N_R-k\ge 2N$, which is not possible, given $N_R<N$ and $k\ge0$. We have thus shown that selling some (but not all) products from S_R in the M mode is a dominated strategy.

The other possible strategy to consider is that, in addition to the N_R products in S_R, the intermediary sells k products from S_M in the R mode, where $0\le k\le N-N_R$. Denote by S_0 the set of k products from S_M that are sold under the R mode. The intermediary chooses marketing activities $a_i=\theta+\gamma_i+x(N_R+k-1)/2$ for products $i\in S_R$ and $a_i=\theta+\gamma_i$ for products $i\in S_0$ (the latter create no spillovers). Independent suppliers set $a_i=\theta+\delta_i$ for the remaining products $i\in S_M\setminus S_0$. The intermediary's profit is therefore

$$\begin{aligned}\Pi(k)&=(v-f)\sum_{i\in S_R}E\biggl[m-\biggl(\frac{x(N_R+k-1)}{2}-\delta_i\biggr)^2\\&\quad+x\sum_{j\neq i,\,j\in S_R}\biggl(\theta+\gamma_j+\frac{x(N_R+k-1)}{2}\biggr)\biggr]+(v-f)\\&\quad\cdot\sum_{i\in S_0}E\biggl[m-\delta_i^2+x\sum_{j\in S_R}\biggl(\theta+\gamma_j+\frac{x(N_R+k-1)}{2}\biggr)\biggr]\\&\quad+(v-f)\sum_{i\in S_M\setminus S_0}E\biggl[m-\gamma_i^2\\&\quad+x\sum_{j\in S_R}\biggl(\theta+\gamma_j+\frac{x(N_R+k-1)}{2}\biggr)\biggr]-NF\\&=(v-f)\biggl((N_R+k)(V_\gamma-V_\delta)+N(m-V_\gamma)+x\theta N_R(N-1)\\&\quad+\frac{x^2}{4}N_R(N_R+k-1)(2N-N_R-k-1)\biggr)-NF.\end{aligned}$$

We therefore have

$$\Pi(k)\ge\Pi(k-1)\Longleftrightarrow V_\delta-V_\gamma<\frac{x^2}{4}N_R(2(N-N_R)+1-2k).$$

Note that the right-hand side of the last inequality is strictly decreasing in k. Thus, there is a unique value of k^* that maximizes $\Pi(k)$ over $k\in[0,N-N_R]$. In particular, $k^*=N-N_R$ (i.e., the R mode) is optimal if $V_\delta-V_\gamma\le(x^2/4)N_R$. On the other hand, $k^*=0$ (i.e., only the products in S_R are sold in the R mode) is optimal if

$$V_\delta-V_\gamma\ge\frac{x^2}{4}N_R(2(N-N_R)-1).\tag{A1}$$

Otherwise, k^* satisfies the bounds in (18).

The intermediary's profit is then $\max\{\Pi(k^*),\Pi_M\}$, where Π_M is the profit obtained with the M mode

$$\Pi_M=(v-f)(N(m-V_\gamma)+x\theta N_R(N-1))-NF.$$

The M mode yields higher profits than $\Pi(0)$ if and only if

$$V_\delta-V_\gamma\ge\frac{x^2}{4}(1-N_R^2+2N(N_R-1)).\tag{A2}$$

Since $N_R^2+N_R\ge 2N-1$, we have that (A2) implies (A1). Thus, if $\Pi_M>\Pi(0)$, then the M mode will be chosen. If, on the other hand, $\Pi_M\le\Pi(0)$, then the optimal solution is given by the previously described k^*. □

Proof of Proposition 10. Compare intermediary profits in (19) with n_R products in the R mode versus n_R-1 products in the R mode. Offering n_R products in the R mode is better than offering n_R-1 products if and only if $2\alpha(N-n_R)+V_\gamma>V_\delta$. Starting from $n_R=1$, the left-hand side of the inequality is strictly decreasing in n_R, so there will be a unique optimal value of n_R for all parameter values. The intermediary's profit is higher with $n_R=0$ than with $n_R=1$ if and only if $V_\delta>V_\gamma+2\alpha(N-1)$, which implies that the optimal n_R is 0. Likewise, the intermediary's profit is higher with $n_R = N$ than with $n_R = N-1$ if and only if $V_\delta < V_\gamma$, which implies that the optimal n_R is N. The optimal model is therefore an interior hybrid whenever $V_\gamma < V_\delta < V_\gamma + 2\alpha(N-1)$. In this case, the optimal number n_R^* satisfies $2\alpha(N-n_R^*) + V_\gamma > V_\delta$ and $2\alpha(N-(n_R^*+1)) + V_\gamma < V_\delta$, so its bounds are determined in (20). □

Appendix B. Robustness

This appendix provides the formal analysis for the various generalizations of §5. It shows the robustness of our benchmark trade-offs in each case.

B.1. Costly Marketing Activities

Let us first analyze the benchmark model with the alternative formulation of marketing activities introduced in §5.1 of the paper. We assume throughout that (1) is adjusted to ensure that M can obtain a positive profit in each case, as we did for the different settings in §3.

The optimal level of marketing activities chosen by a reseller for each product is

$$a_i^R = \frac{(v-f)(\theta+\gamma_i)}{\kappa},$$

implying that the reseller's profit, given all products are offered, is

$$\Pi_R = N\left((v-f)m + \frac{(v-f)^2(\theta^2+V_\gamma)}{\kappa} - F\right). \quad \text{(B1)}$$

In the case of a marketplace, the result of profit maximization by supplier i is

$$a_i^M = \frac{(v-f)(\theta+\delta_i)}{\kappa},$$

implying a marketplace that can extract full profits from each supplier obtains

$$\Pi_M = N\left((v-f)m + \frac{(v-f)^2(\theta^2+V_\delta)}{\kappa} - F\right).$$

Comparing Π_M with Π_R, the M mode is preferred to the R mode if and only if $V_\delta \geq V_\gamma$, i.e., exactly the same result as in Proposition 1 in the main text.

It is also straightforward to show that the analyses with spillovers, cost differences, and network effects are very similar to the ones in the model with horizontal marketing activities in the main text. Specifically, Proposition 2 remains unchanged. The formulas in Propositions 3–5 are somewhat modified but the key trade-offs remain the same.

B.2. Supplier Bargaining Power

Consider first the baseline model. The reseller offers each supplier a wholesale price w so as to extract a share $(1-\beta)$ of the expected joint profits created by the supplier's product (net of the fixed cost F). Given that the optimal choice of marketing activity is unaffected by the wholesale price, the expected profit generated per supplier is still $(v-f)\cdot(m-V_\delta) - F$.[9] Consequently, the reseller sets w so that its expected profit from supplier i is

$$(v-f-w)(m-V_\delta) - F = (1-\beta)((v-f)(m-V_\delta) - F),$$

implying that

$$w = \frac{\beta}{m-V_\delta}((v-f)(m-V_\delta) - F).$$

Applying the same rule for all N suppliers implies that the reseller's profit is

$$\Pi_R = N(1-\beta)((v-f)(m-V_\delta) - F).$$

Similarly, the marketplace sets its fixed fee P to suppliers so as to extract a share $(1-\beta)$ of the expected joint profits. Since the supplier's optimal choice of marketing activity does not depend on the fixed participation fee, the expected profit generated per supplier is still $(v-f)(m-V_\gamma) - F$. Consequently, the marketplace sets the fixed participation fee P such that

$$P = (1-\beta)((v-f)(m-V_\gamma) - F).$$

Collecting this from all N suppliers leads to

$$\Pi_M = N(1-\beta)((v-f)(m-V_\gamma) - F).$$

Consequently, the M mode is preferred to the R mode if and only if $V_\delta > V_\gamma$, the same result as in Proposition 1.

It is easily seen that the analysis above also applies to the cases with spillovers (assuming favorable expectations if spillovers are positive) and with cost differences. Thus, Propositions 2 and 3 remain unchanged. The one setting where the details do change somewhat is in the scenario with network effects and unfavorable expectations, although the essential trade-offs in that case remain broadly the same.

B.3. Downward-Sloping Supplier Demand

Suppose that suppliers are heterogeneous in m, i.e., m is distributed on $[m_L, m_H]$ with CDF $G(\cdot)$ and corresponding density $g(\cdot)$, and that the intermediary does not observe each individual supplier's m_i. We also assume that

$$(v-f)(m_L - \max(V_\gamma, V_\delta)) > F$$

so that all products are profitable. Given unobserved heterogeneity in m, it is natural to allow both M and R to charge fixed and variable fees. Specifically, the marketplace charges the fixed fee P_M and the variable fee p, whereas the reseller charges the fixed fee P_R and offers suppliers a bid b per product unit it buys from them.

Consider first the M mode. A supplier with $m_i = m$ participates in the marketplace if and only if

$$m \geq \hat{m} \equiv \frac{P_M + F}{v-f-p} + V_\gamma.$$

[9] In the alternative model of marketing activities considered in §5.1, the choice of marketing activity would be affected by the wholesale price paid to suppliers, but this would not change our results since the reseller would do better to set $w = 0$ and instead make a fixed payment to each supplier equal to $\beta((v-f)(m-V_\delta) - F)$.

Thus, M's profit is

$$\max_{P_M,\, p}\{(P_M + p(E(m \geq \hat{m}) - V_\gamma))(1 - G(\hat{m}))\}$$
$$= \max_{\hat{m},\, p}\{((v-f)(m - V_\gamma) + p(E(m \geq \hat{m}) - m) - F)(1 - G(\hat{m}))\}.$$

Clearly, the last expression is increasing in p up to $v - f$, so we obtain

$$\Pi_M = \max_{\hat{m}}\{((v-f)(E(m \geq \hat{m}) - V_\gamma) - F)(1 - G(\hat{m}))\}. \quad \text{(B2)}$$

Similarly, R's profit is

$$\max_{P_R,\, b}\{(P_R + (v - f - b)(E(m \geq \hat{m}) - V_\delta) - F)(1 - G(\hat{m}))\},$$

where

$$b(\hat{m} - V_\delta) - P_R = 0$$

so that R's profit can be rewritten as

$$\max_{\hat{m},\, b}\{(b(\hat{m} - V_\delta) + (v - f - b)(E(m \geq \hat{m}) - V_\delta) - F)(1 - G(\hat{m}))\}.$$

The last expression is decreasing in b down to zero, so we obtain

$$\Pi_R = \max_{\hat{m}}\{((v-f)(E(m \geq \hat{m}) - V_\delta) - F)(1 - G(\hat{m}))\}. \quad \text{(B3)}$$

Comparing the two profits (B2) and (B3), it is clear that M is preferred to R if and only if $V_\delta > V_\gamma$, the same condition as in our benchmark model. It is also straightforward to prove that in the current setting with no cost differences, an interior hybrid mode is never optimal. This feature also parallels the benchmark model.

B.4. Buyer Surplus and Affiliation

Assume that buyers incur heterogeneous opportunity costs c when joining the intermediary (M or R), where c is distributed with the CDF $D(\cdot)$. Furthermore, we replace the pricing mechanism in the main text with Nash bargaining. Specifically, we assume that after joining the intermediary, each buyer engages in Nash bargaining with the owner of the product i she is interested in. When supplier i sells directly to buyers (in the M mode), supplier i's bargaining power is α_M so that the supplier's and buyer's payoffs from the interaction are

$$\pi_M = \alpha_M(v - f_M) \quad \text{and} \quad s_M = (1 - \alpha_M)(v - f_M).$$

When R sells to buyers, its bargaining power is $\alpha_R \geq \alpha_M$. This captures the fact that R aggregates the bargaining power of all suppliers. In this case, the payoff to R and the buyer from one product transaction are, respectively,

$$\pi_R = \alpha_R(v - f_R) \quad \text{and} \quad s_R = (1 - \alpha_R)(v - f_R).$$

Since it is assumed that $f_M \geq f_R$ and $\alpha_M \leq \alpha_R$, we always have $\pi_R \geq \pi_M$. On the other hand, it is possible that $s_M \geq s_R$ (i.e., buyers may derive more surplus from their interactions with individual suppliers on M because they have more relative bargaining power, which may compensate for the higher cost). We also allow M and R to have different fixed costs, F_R and F_M, respectively, as in §3.2.

Finally, to keep things simple, we assume that the intermediary cannot charge any fixed fees to buyers for affiliation (neither as M nor as R). If this were possible, M may be able to partially offset the inferior bargaining power of its suppliers relative to R.

The rest of the model is unchanged. Assuming that each buyer is interested in one product only, demand for product i is now $(m - (a_i - a_i^*)^2)D(s_M)$ if the intermediary behaves as a marketplace, and $(m - (a_i - a_i^*)^2)D(s_R)$ if the intermediary behaves as a reseller. These expressions suggest that the M mode now has an additional advantage whenever $s_M > s_R$ since it creates more buyer demand as buyers retain more surplus.

With these demand expressions, it is straightforward to derive the profits of M and R (the analysis is almost identical to the one in §3.2), obtaining

$$\Pi_R(N) = N(\pi_R(m - V_\delta)D(s_R) - F_R),$$
$$\Pi_M(N) = N(\pi_M(m - V_\gamma)D(s_M) - F_M).$$

Taking the difference and rearranging terms, we obtain that the M mode is preferred to the R mode if and only if

$$\pi_R D(s_R)V_\delta > \pi_M D(s_M)V_\gamma + m(\pi_R D(s_R) - \pi_M D(s_M)) - (F_R - F_M),$$

which is similar to the trade-off including the cost differences expressed in (13). The only difference is that $(v - f_M)$ and $(v - f_R)$ have been replaced by the more general terms $\pi_M D(s_M)$ and $\pi_R D(s_R)$, respectively.

If we eliminate cost differences by setting $f_R = f_M = f$ and $F_R = F_M = F$, then, since $m > V_\gamma$ by assumption, the trade-off is shifted in favor of M relative to the benchmark trade-off in Proposition 1 if and only if

$$\pi_M D(s_M) > \pi_R D(s_R),$$

i.e., if and only if

$$\alpha_M(v - f)D((1 - \alpha_M)(v - f)) > \alpha_R(v - f)D((1 - \alpha_R)(v - f)).$$

This represents a simple trade-off: the R mode allows the intermediary to extract more rents from the buyers who join, but for this exact reason, the M mode may attract a larger number of buyers.

B.5. Price as the Noncontractible Decision Variable

Suppose that there are N products with demand for product i given by

$$m + \delta_i + \gamma_i - p_i + \frac{x}{N-1}\sum_{j \neq i} p_j,$$

where $-1 < x < 1$. The demand shock δ_i is the local information of supplier i, and the demand shock γ_i is the local information of the intermediary. We assume that δ_i and γ_i are i.i.d. draws from independent distributions, with expected values and variances V_δ and V_γ, respectively. All marginal and fixed costs are set to zero for simplicity, and so there are no cost differences between the two modes, as in §3.

The reseller does not observe $(\delta_1, \ldots, \delta_N)$ but can set $(p_1, \ldots, p_N)$ to account for demand spillovers and its local information $(\gamma_1, \ldots, \gamma_N)$. It therefore solves

$$\max_{p_1,\ldots,p_N} \left\{ \sum_{i=1}^{N} p_i \left(m + \gamma_i - p_i + \frac{x}{N-1} \sum_{j \neq i} p_j \right) \right\}.$$

The first-order condition in p_i yields

$$p_i^* = \frac{m + \gamma_i}{2} + \frac{x}{N-1} \sum_{j \neq i} p_j^*. \tag{B4}$$

Taking the sum of these conditions over $i = 1, \ldots, N$, and noting that $\sum_{i=1}^{N} \sum_{j \neq i} p_j^* = (N-1) \sum_{i=1}^{N} p_i^*$, we obtain

$$\sum_{i=1}^{N} p_i^* = \frac{Nm}{2(1-x)} + \frac{\sum_{i=1}^{N} \gamma_i}{2(1-x)}. \tag{B5}$$

Subtracting (B4) from (B5), we can obtain $\sum_{j \neq i} p_j^*$, and substituting this into (B4), we obtain

$$p_i^* = \frac{m}{2(1-x)} + \frac{a}{2}\gamma_i + \frac{b}{2} \sum_{j \neq i} \gamma_j,$$

where the parameters a and b are defined by

$$a \equiv \frac{(N-1) - (N-2)x}{(N-1) - (N-2)x - x^2} \quad \text{and}$$
$$b = \frac{x}{(N-1) - (N-2)x - x^2}.$$

From the perspective of the initial stage,

$$\Pi_R = \sum_{i=1}^{N} \left[E[p_i^* m] + E[p_i^* \gamma_i] - E[(p_i^*)^2] + \frac{x}{N-1} \sum_{j \neq i} E[p_i^* p_j^*] \right].$$

We have

$$E[p_i^* m] = \frac{m^2}{2(1-x)}; \quad E[p_i^* \gamma_i] = \frac{a}{2} V_\gamma,$$
$$E[(p_i^*)^2] = \frac{m^2}{4(1-x)^2} + \frac{a^2 + (N-1)b^2}{4} V_\gamma,$$
$$E[p_i^* p_j^*] = \frac{m^2}{4(1-x)^2} + \frac{2ab + (N-2)b^2}{4} V_\gamma.$$

Plugging these expressions in Π_R above and using the definitions of a and b, we finally obtain

$$\Pi_R = N \left(\frac{m^2}{4(1-x)} + \frac{(N-1-x(N-2))}{4(1-x)(N-1+x)} V_\gamma \right).$$

Consider now M's problem. It sets a participation fee that extracts the entire expected surplus from each supplier. Supplier i sets p_i to maximize

$$\pi_i = p_i \left(m + \delta_i - p_i + \frac{x}{N-1} \sum_{j \neq i} E_i[p_j] \right),$$

where $E_i[p_j]$ denotes the expectation of p_j from the perspective of supplier i. This implies that

$$p_i^* = \frac{1}{2}\delta_i + \frac{1}{2} \left(m + \frac{x}{N-1} \sum_{j \neq i} E_i[p_j^*] \right). \tag{B6}$$

Taking expectations of both sides (and using the fact that $E_i(\delta_j) = 0$) yields

$$E_i[p_j^*] = \frac{m}{2-x}. \tag{B7}$$

Substituting (B7) into (B6), we obtain

$$p_i^* = \frac{1}{2}\delta_i + \frac{m}{2-x}.$$

Substituting p_i^* into π_i and taking expectations, we obtain

$$\pi_i = \frac{V_\delta}{4} + \frac{m^2}{(2-x)^2}.$$

Thus, summing over all N suppliers implies that

$$\Pi_M = N \left(\frac{V_\delta}{4} + \frac{m^2}{(2-x)^2} \right).$$

We can now compare the resulting profits under the two intermediation modes by taking the difference. We obtain

$$\Pi_M - \Pi_R = N \left(\frac{V_\delta}{4} - \frac{N-1-x(N-2)}{4(1-x)(N-1+x)} V_\gamma - \frac{m^2 x^2}{4(1-x)(2-x)^2} \right).$$

This difference is clearly increasing in V_δ and decreasing in V_γ, so the M mode is preferred when V_δ is sufficiently high, whereas the R mode is preferred when V_γ is sufficiently high. If there are no spillovers so $x = 0$, then $\Pi_M - \Pi_R = N(V_\delta - V_\gamma)/4$, so the trade-off is identical to the one given in Proposition 1. Moreover, it is easily verified that $\Pi_M - \Pi_R$ is decreasing in $|x|$. Thus, the presence of spillovers unambiguously shifts the trade-off in favor of R, regardless of their sign. This result corroborates the one obtained in Proposition 2.

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